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United States Department of Agriculture
Bureau of Entomology and Plant Quarantine

AN APHID TRAP

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During the course of biological studies of aphids affecting potatoes in Maine, emphasis was placed upon the development of a trap suitable for a study of the movement of these insects through the air. Of the several kinds of traps employed, one proved very satisfactory under the conditions prevailing at Presque Isle, Maine. The favorable results obtained as a result of the operation of this trap during the latter part of the active season in 1941 suggest the possibility that a description of the apparatus may be of value to other workers engaged in similar studies.

The particular advantages of the trap described here are that it is inexpensive, simple to construct and operate, and reasonably efficient in catching and retaining alate aphids. In addition, the aphids caught are usually in perfect condition for immediate identification when collected daily from the trap. The total cost of the materials and labor used in constructing the trap is less than \$2. The trap operates unattended, and it can be emptied by using an inexpensive suction apparatus.

The disadvantages of this trap are that it does not operate effectively during periods when the air is perfectly calm, considerable time is required for removing the aphids from the trap when large numbers are caught, and some of the aphids may escape before they are removed by the operator (this is especially true of the larger, more active species).

Description

The trap has the shape of a curved horn with the plane of the big end or base mounted in a vertical position. The profile is such that a line from the center of the square base to the apex bends upward to a circular, apical opening. The plane of this circular opening is at right angles to the vertical base. A swivel mounting is attached to the bottom of the square opening, thus

permitting the trap to function as a windvane and keeping its larger square opening steadily facing directly into the wind. Photographs showing front, side, and back views of the trap are presented in figure 1.

The vertical front opening, $19\frac{1}{2}$ inches square, is framed with a metal rod, $\frac{1}{8}$ inch in diameter, welded at one corner. The horizontal, apical opening^{1/} is bounded by a metal ring $3\frac{1}{2}$ inches in diameter that lies slightly above and about 15 inches behind the top of the square trap opening. Metal rods $\frac{1}{8}$ inch in diameter, welded to the corners of the front opening, curve upward and inward and are welded to the apical ring equidistantly about its circumference. The 4 rods thus attached form the framework for the walls of the trap, which are made by covering the frame with a good grade of cotton scrim (sometimes sold under the name of marquisette), with tightly twisted threads, approximately 28 by 34 strands to the square inch. Care must be taken in fastening the scrim to the rods so that no folds exist about the rods to hamper the removal of aphids from the trap.

The tips of the upper ends of the 4 rods forming the framework for the trap walls are bent up sharply before being welded to the circular ring, so as to form a neck about $\frac{1}{2}$ inch long beneath the ring. In operation, the upper opening of the trap is covered by a "baker's cap" 6 to 8 inches in diameter, finished, the top of which is held flat and in place by 4 equally spaced snaps. The cap is made from a circle of scrim, with its hem gathered by elastic tape for holding it in place. The snaps are sewed into the cap so as to lie just outside of the $3\frac{1}{2}$ -inch metal ring. In other words, one part of each snap should be fastened about 2 inches from the center of the cap and the other directly beneath and about 1 inch from the elastic.

A steel shaft $\frac{1}{4}$ inch in diameter, welded to the middle of the rods forming the top and bottom of the square opening, extends below for a distance of 6 inches. The end of this supporting shaft rests on a ball bearing held in a short length of pipe of slightly larger diameter than the shaft. The pipe, one end of which is closed to retain the ball bearing, is sunk into a post of the desired height. Experience has shown that a more satisfactory mounting can be made by welding short rods from the bottom corners of the front opening to the center supporting shaft a few inches below the opening, thus making unnecessary that portion of the supporting shaft which extends vertically through the front opening (fig. 1). In this case it is necessary to extend the shaft more than 6 inches below the bottom wire of the front opening.

^{1/} The apical ring of the particular trap illustrated in figure 1 does not happen to be quite at right angles to the plane of the trap opening.

Emptying the Trap

By using a small suction apparatus, the aphids are first taken from the inside walls of the trap, with the operator working through the trap opening. The cap is then carefully removed, turned upside down, and closed by folding gently. Any specimens falling back into the trap while the cap is being removed are next taken out. Following this the cap, remaining in the inverted position, is gently opened, and all specimens within reach are removed. The snaps are then separated, and all aphids in the rim of the cap are removed. When the catch is small, a mouth-suction apparatus is adequate, but when it is large, a power-driven apparatus may be employed to advantage.

Performance

The performance of this trap in operation 12½ feet above the soil is indicated by the data presented in table 1, which show, by species of chief interest, the numbers of winged aphids taken from the trap daily during the period of August 14 to October 4, 1941, at Presque Isle, Maine.

The following features of the trap appear to be responsible for its effectiveness: (1) The walls slope upward and inward from the trap opening, terminating at a horizontal opening covered by a loose cap of open weave; and (2) the cap, held to the circular opening by an elastic band, is rather full and has 4 snaps so attached as to insure at all times a continuous large fold around its rim. When the wind is blowing, it tends to keep the cap open so that aphids more readily enter the folds. When the wind dies down the cap tends to settle, thus effectively trapping the aphids without injuring them. Wind currents hitting the back of the trap are to some extent diverted upward, thereby tending to funnel upward toward the cap all aphids entering the front opening. The wind also produces a slight boosting effect on aphids which alight on the back-wall of the trap, causing them to walk or roll gently upward toward the cap. Observations indicate that some of the aphids exhibit a tendency to crawl upward after landing in the trap. This movement seems to be a natural preparation for subsequent flight. The large fold in the cap provides a hiding place for the aphids, from which they do not readily escape. Observations also tended to indicate that more aphids either entered or were retained more effectively in traps having the plane of the upper opening lying at right angles to that of the front opening than in traps otherwise adjusted.

Detailed studies have not been made regarding the numbers of aphids which escape after entering the trap. In one test, however, approximately 21 percent fewer aphids were taken from a

Table 1.--The numbers of winged aphids, by species, taken daily from a trap, similar to that shown in figure 1, operated 12½ feet above the ground. Presque Isle, Maine. 1941.

Date	Aphis abbreviata	Myzus persicae	Macrosiphum solanifolii	Other species	Total
Aug. 14	0	4	0	0	4
15	4	12	1	10	27
16	17	75	11	35	138
17	241	346	25	71	683
18	49	7	1	3	60
19	190	54	3	34	281
20	56	159	12	25	252
21	84	28	5	18	135
22	15	2	0	2	19
23	3,001	267	50	81	3,399
24	249	77	10	82	418
25	6	9	0	2	17
26	4,226	248	56	136	4,666
27	214	23	5	17	259
28	70	13	4	17	104
30	1,056	68	16	15	1,155
31	29	18	1	1	49
Sept. 1	1,213	310	36	10	1,569
2	208	33	1	8	250
3	16	7	2	1	26
4	1,069	515	70	42	1,696
5	993	243	221	19	1,277
6	36	3	0	1	40
7	325	152	13	14	504
8	54	109	5	6	174
9	66	28	8	4	106
10	246	236	31	10	523
11	69	96	0	16	181
12	7	6	0	8	21
13	4	7	0	0	11
14	12	14	0	3	29
15	30	41	0	23	94
16	8	12	2	10	32
17	47	7	2	0	56
18	21	19	0	33	77
19	0	0	0	3	3
20	0	0	0	0	0
24	10	28	0	146	184
28	0	3	0	32	35
29	0	1	0	24	25
30	0	0	0	2	2
Oct. 1	1	1	0	7	9
2	1	1	0	4	6
3	1	3	0	19	23
4	2	0	0	9	11

trap emptied once in 24 hours than from a similar trap operated at the same location and at the same height but emptied hourly during the daylight hours.

An analysis of the data showed that a trap of the same design, but with all dimensions reduced so that the front opening was 12 inches square, caught and retained proportionally as many of the three important aphid species listed in table 1 as were caught by the larger trap described herein. Although the large trap caught more aphids, when adjustments were made on the basis of the relative areas of the trap openings, there were no appreciable differences either in the adjusted total numbers of aphids or in the relative abundance of these three species. On this basis, the smaller trap could be used satisfactorily when large numbers of the aphids are flying, thereby reducing materially the time required to identify and count the aphids caught. If traps of both sizes are used during the course of the season, the data obtained from each size can be made directly comparable by a simple mathematical transformation.

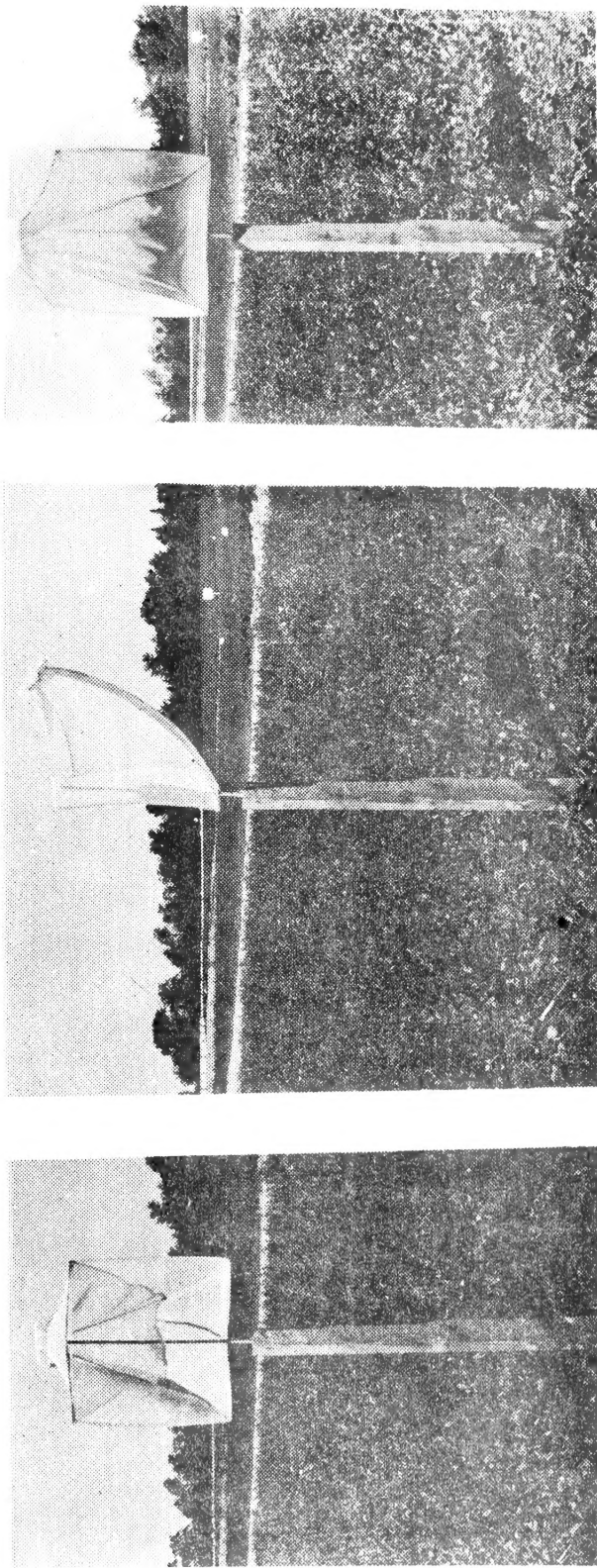


Figure 1.—Front, side, and back views of the aphid trap.

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